EXCITED FRAME, VIBRATORY CONVEYING APPARATUS FOR MOVING PARTICULATE MATERIAL

BACKGROUND OF THE INVENTION

This invention relates to excited frame vibratory conveying apparatus for conveying particulate material.

In most vibratory conveying systems, the vibratory drive is connected directly to the conveying frame or bed. Some experimentation has been conducted in which the vibratory device is connected to a support frame in which the support frame is excited or primarily vibrated with the vibration being transferred through springs indirectly to the conveying member or bed. Such systems have been referred to in the past as two mass, two spring vibratory conveyor systems or excited frame vibratory systems. Such past attempts have been described in the Long et al U.S. Pats. Nos. 2,876,891, and 2,951,581 granted Mar. 10, 1959 and Sept. 6, 1970 respectively. Additionally the Luger U.S. Pat. No. 3,380,572 granted Apr. 30, 1968 describes a similar system. The basic objective is to design such a system in which the vibration amplitude of the excited frame approaches zero while the conveyor bed or member is vibrated at its natural frequency of maximum amplitude. The principal variables are the rpm of the vibratory drive member, the spring constant of the support springs supporting the conveyor bed on the excited frame, the weight of the conveyor bed, the weight of the product or load being conveyed and the weight of the excited frame. The generally recognized advantages of such a system over conventional direct vibratory conveyors is that it is possible under some conditions to transfer less vibration into the floor or ceiling supports and to provide a conveyor that is considerably less massive than the direct drive vibrating systems.

However, one of the principal problems associated with excited frame vibratory conveyors involves vertical rocking of the conveying member and the transmission of substantial vertical forces into the stationary supporting structure. Long et al in U.S. Pat. No. 2,951,581 contends that such rocking problems may be solved by utilizing substantially vertical leaf or beam springs between the stationary supporting structure and the excited frame. Long et al contends that soft or coil springs that "float" the system are unsatisfactory and do not provide the proper vertical rigidity required to prevent rocking.

One of the principal objects and advantages of this invention is to provide a greatly improved excited frame, vibratory conveyor apparatus utilizing a "floating" suspension resilient support system in which the rocking or eccentric forces are greatly reduced.

A further object of this invention is to provide a greatly improved "excited frame" vibratory conveyor apparatus that is capable of operating over a rather large range of loading without adversely affecting its operation.

A further object of this invention is to provide an improved excited frame, vibratory conveying apparatus that is very simple in structure and economical in manufacture to enable the apparatus to enjoy a wide usage for conveying various particulate material.

These and other objects and advantages of this invention will become apparent upon reading the following detailed description of a preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred and alternate embodiments of this invention are illustrated in the accompanying drawings, in which:

FIG. **1** is an isometric view of the excited frame, vibratory conveying apparatus that is the subject of this invention;

FIG. **2** is a vertical cross sectional view taken along line **2—2** in FIG. **1**;

FIG. **3** is a schematic view of the relationship between the line of vibratory force with respect to centers of masses of several components;

FIG. **4** is an enlarged fragmentary side elevational view of a beam spring assembly utilized to support a conveyor member on an excited frame;

FIG. **5** is a vertical transverse cross sectional view taken along line **5—5** in FIG. **1**;

FIG. **6** is a fragmentary side elevational view of the alternate system for supporting the conveyance system from an overhead support structure as opposed to a floor mounted system illustrated in FIGS. **1** and **2**; and

FIG. **7** is a vertical cross sectional view taken along line 7—7 in FIG. **6**.

DETAILED DESCRIPTION OF A PREFERRED AND ALTERNATE EMBODIMENT

Referring now to the drawings, there is illustrated in FIG. **1** an excited frame, vibratory conveying apparatus generally designated with the numeral **10** that is supported on a base or stationary support **12**. In FIG. **1** the stationary support **12** includes pillars that are floor mounted. In FIGS. **6** and **7**, the conveying apparatus **10** is mounted from an elevated support such as a ceiling.

The conveying apparatus **10** includes an excited frame means **13** having an elongated frame **14** generally extending in an intended direction of movement of particulate material from a rear end **17** to a front end **16**. The excited frame **14** is preferably rather lightweight and includes side channels **19** and **20** that extend between the front and rear end **16**, **17**. Cross braces **22** (FIG. **2**) extend between the side channels **19** and **20** to provide a rather rigid frame structure.

The elongated frame **14** includes front feet **23** and rear feet **24** for supporting the apparatus on resilient support means that are in turn fixed or supported on the stationary base **12**. In a preferred embodiment the resilient support means includes pneumatic spring mounts and more preferable low profile air/rubber mounts **26** adjacent the front end and air/rubber mounts **28** adjacent the rear ends to support the apparatus both for and aft. The air/rubber mounts **26**, **28** may be referred to as cushions for principally absorbing vertical vibratory forces. Satisfactory air/rubber mounts may be purchased from Barry Wright Corp. under the trademark "Stabl-Levl". The air/rubber mounts **26**, **28** would not be considered as vertically stationary springs as suggested in the Long et al U.S. Pat. No. 2,951,581. The applicant's apparatus is principally designed to minimize both longitudinal and vertical forces being transmitted from the excited frame to the base **12**. The applicant has found that it is not necessary to provide vertically rigid leaf or beam spring mounts for supporting the excited frame **14**.